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(54) **Spring arrangement for a recreational structure**

(57) A spring arrangement for a trampoline that includes a rebounding surface (1310), a frame structure (1301) having a top portion and a bottom portion and a plurality of spring members (1303) that are mechanically coupled between the rebounding surface and the frame structure. A first group of spring members (1303) are mechanically coupled to the top portion of the frame structure and a second group of spring members (1303) are mechanically coupled to the bottom portion of the frame structure. In one exemplary embodiment, each spring member of the second group of spring members has a frame hook member that is mechanically coupled to the bottom portion of the frame structure and a bed hook member that includes an end portion that is configured to be within a projection of a body of the spring member and is coupled to the rebounding surface.

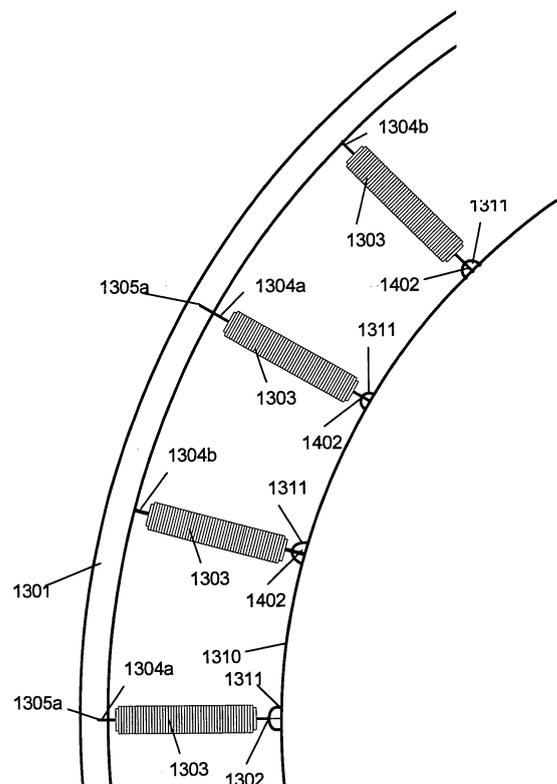


FIG. 14

Description

BACKGROUND

5 **[0001]** The subject matter disclosed herein relates to recreational structures. More particularly, the subject matter disclosed herein relates to a spring arrangement and a frame arrangement for a recreational structure, such as a trampoline.

10 **[0002]** Recreational structures having frames, such as trampolines, are well-known. For example, a trampoline has a horizontal frame to which a rebounding surface is attached and a plurality of vertical frame members, or legs, that support the horizontal frame and rebounding surface above the ground. While the horizontal and vertical frame portions of a trampoline could be fabricated to be one unitary structure, such a unitary structure is cumbersome when the trampoline frame is transported to a place where the trampoline is used. Accordingly, trampoline frames are typically formed from a plurality of pieces that are fastened together at the time a trampoline is assembled.

15 **[0003]** Additionally, Figure 1 illustratively depicts the forces that are applied to a frame of a trampoline that has conventionally configured spring members. More specifically, Figure 1 illustratively depicts a cross-sectional view of a frame 101 that is part of, for example, a circular frame that forms the perimeter of a trampoline. Frame 101 is disposed on a vertical frame member 102, such as a leg of the trampoline. A spring member 103 mechanically connects a rebounding surface (not shown) to frame 101. In particular, a hook member 104 that is part of spring member 103 is inserted through a hole 105 (not plainly shown in Figure 1) that is in the "top" of frame 101. Other spring members that are disposed behind spring member 103 and are not visible in Figure 1 are mechanically connected to frame 101 in the same manner has shown in Figure 1.

20 **[0004]** As the rebounding surface of the trampoline is jumped on, a horizontal force 106 and a vertical force 107 are applied to spring member 103 that is transmitted to frame 101. The nature of the mechanical connection of spring member 103 to frame 101, that is, the mechanical connection of hook member 104 through hole 105, causes a torque 108 to be applied to frame 101. Torque 108 causes vertical frame member 102 to bow outward from the center of the trampoline, as depicted by arrow 109.

25 **[0005]** The cyclic loading caused by torque 108 has a tendency to cause fatigue in vertical frame member 102 at the mechanical connection between frame 101 and vertical frame member 102 and along the length of vertical frame member 102.

30 **[0006]** What is needed is a technique for reducing the torque applied to a frame member of a trampoline, thereby minimizing the bowing and the fatigue caused in a vertical frame member of a trampoline. Additionally, desirable characteristic for all trampoline frames formed from a plurality of pieces is that the various pieces are attached or joined to each other using a technique that is simple, quick to assemble and is reliable.

BRIEF SUMMARY

35 **[0007]** The subject matter disclosed herein provides a technique for reducing the torque applied to a frame member of a trampoline, thereby minimizing the bowing and the fatigue caused in a vertical frame member of a trampoline. The subject matter disclosed herein also provides a technique for joining structural components of a recreational structure, such as a trampoline, that is simple, quick to assemble and is reliable.

40 **[0008]** The subject matter disclosed herein provides a spring arrangement for a trampoline that includes a rebounding surface, a frame structure having a top portion and a bottom portion, and a plurality of spring members that when in use are mechanically coupled between the rebounding surface and the frame structure. According to the subject matter disclosed herein, a first group of spring members are mechanically coupled to the top portion of the frame structure and a second group of spring members are mechanically coupled to the bottom portion of the frame structure. In one illustrative embodiment, each spring member of the second group of spring members has a frame hook member that is mechanically coupled to the bottom portion of the frame structure and a bed hook member that includes an end portion that is configured to be within a projection of a body of the spring member and is coupled to the rebounding surface. In another illustrative embodiment, each spring member of the first and second groups of spring members has a frame hook member that is mechanically coupled to the top portion of the frame structure and a bed hook member that includes an end portion that is configured to be within a projection of a body of the spring member and is coupled to the rebounding surface. In still another illustrative embodiment, the spring members of the first group and the second group are alternately arranged along the frame structure. In yet another illustrative embodiment, the frame structure is formed by a plurality of frame members.

45 **[0009]** The subject matter disclosed herein also provides a recreational structure frame system that includes a plurality of horizontal frame members, at least one vertical frame member, at least one vertical pole member, and at least one sleeve-joint coupling. Each horizontal frame member has two ends. Similarly, each vertical frame member has two ends, and each vertical pole member has two ends. In one exemplary embodiment, at least one sleeve-joint coupling has first,

second and third arm members arranged to substantially form a T configuration and an aperture that is formed in the sleeve-joint coupling. That is, the first arm member and the aperture are disposed in an opposite relationship with respect to each other, and the second arm member and the third arm member are disposed in an opposite relationship with each other. In another exemplary embodiment, at least one sleeve-joint coupling includes a side sleeve member having the aperture. The first arm member receives one end of a vertical frame member. The aperture receives one end of a vertical pole member. The second and third arm members each receive one end of a horizontal frame member. The vertical pole member received by the aperture extends through the sleeve-joint coupling into an inner portion of the vertical frame member received by the first arm of the sleeve-joint coupling. A tension member, such as a chain, cord, rope, cable or strap, applies a force between a vertical frame member and a corresponding vertical pole member that compresses the vertical frame member toward the corresponding vertical pole member. In one exemplary embodiment, the tension member is internal to the vertical frame member and the corresponding vertical pole member and the tension member extends through an opening in the vertical pole member. A ground-fastening device, such as a stake, is coupled to the portion of the tension member that extends through the opening in the vertical frame member and is fasten to the ground.

[0010] The vertical pole member can be part of, for example, a safety enclosure, in which case the safety enclosure can include a plurality of vertical pole members, such that each vertical pole member is received into the aperture of a sleeve-joint coupling. A plurality of horizontal support members can be coupled to two adjacent vertical pole members, thereby forming the safety enclosure. In one exemplary embodiment, the vertical pole member is configured to substantially form an arch.

[0011] One exemplary embodiment of a sleeve-joint coupling according to the subject matter disclosed herein includes a fourth arm member, in which case the aperture is disposed at an end of the fourth arm member. A frame tension member can be coupled between adjacent sleeve-joint couplings that applies a force to the adjacent sleeve-joint couplings and forces the adjacent sleeve-joint couplings toward each other.

[0012] The subject matter disclosed herein further provides a recreational structure frame system that includes a plurality of horizontal frame members, at least one vertical frame member, at least one vertical pole member, and at least one sleeve-joint coupling. Each horizontal frame member has two ends. Similarly, each vertical frame member has two ends, and each vertical pole member has two ends. In one exemplary embodiment, at least one coupling member has first, second and third arm members arranged to substantially form a T configuration. The first arm member and the second arm member are disposed in an opposite relationship with each other. The third arm member includes flange members that receive one end of a vertical frame member and one end of a vertical pole member. The second and third arm members each receive one end of a horizontal frame member.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The subject matter disclosed herein is illustrated by way of example and not by limitation in the accompanying figures in which like reference numerals indicate similar elements and in which:

Figure 1 illustratively depicts the forces that are applied to a frame of a trampoline that has conventionally configured spring members;

Figure 2 depicts a perspective view of an exemplary trampoline having an exemplary safety enclosure;

Figures 3A-3C respectively show a side view, a top view and an end view of the first exemplary embodiment of a sleeve joint coupling for a trampoline frame according to the subject matter disclosed herein;

Figure 3D shows a perspective view of the first exemplary embodiment of a sleeve joint coupling according to the subject matter disclosed herein;

Figure 4 shows details of a first exemplary embodiment of sleeve-joint coupling according to the subject matter disclosed herein;

Figures 5A-5C respectively show a side view, a top view and an end view of a second exemplary embodiment of a sleeve-joint coupling for a trampoline frame according to the subject matter disclosed herein;

Figures 6A-6C respectively show a side view, a top view and an end view of a third exemplary embodiment of a sleeve-joint coupling for a trampoline frame according to the subject matter disclosed herein;

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- Figures 7A-7C respectively show a side view, a top view and an end view of a fourth exemplary embodiment of a sleeve-joint coupling for a trampoline frame according to the subject matter disclosed herein;
- 5 Figures 8A and 8B respectively show a side view and a top view of a fifth exemplary embodiment of a sleeve-joint coupling for a trampoline frame according to the subject matter disclosed herein;
- Figures 9A-9C respectively show a side view, a top view and an end view of a sixth exemplary embodiment of a sleeve-joint coupling for a trampoline frame according to the subject matter disclosed herein;
- 10 Figures 10A-10C respectively show side, top and end views of an exemplary embodiment of a coupling member for a trampoline frame according to the subject matter disclosed herein;
- Figure 11 depicts a top cutaway view of the first exemplary embodiment of a sleeve-joint coupling according to the subject matter disclosed herein;
- 15 Figure 12 shows a cut-away view of an exemplary embodiment of a vertical pole member for a safety enclosure, a sleeve-joint coupling, and a vertical frame member according to the subject matter disclosed herein;
- 20 Figure 13 illustratively depicts the forces that are applied to a frame of a trampoline that has spring members that are configured according to the subject matter disclosed herein;
- Figure 14 is an illustrative top view of a portion of a trampoline that has spring members that are configured according to the subject matter disclosed herein; and
- 25 Figure 15 depicts an illustrative embodiment of a spring member according to the subject matter disclosed herein.

DETAILED DESCRIPTION

- 30 **[0014]** The word "exemplary" is used herein to mean "serving as an example, instance, or illustration." Any embodiment described herein as "exemplary" is not necessarily to be construed as preferred or advantageous over other embodiments.
- [0015]** Figure 2 depicts a perspective view of an exemplary trampoline 200 having an exemplary safety enclosure 201. Trampoline 200 includes a rebounding surface 202 and a frame structure having vertical frame members 203 and a circular frame that can be formed from a plurality of circular frame members 204. Vertical frame members 203 and
- 35 circular frame members 204 are typically made from hollow metal tubing having sufficient strength to bear the stresses and loads that are associated with trampolines. Safety enclosure 201 includes a frame structure having vertical pole members 205 and horizontal support members 206. A horizontal support member 206 is connected between adjacent vertical pole members in a substantially inflexible manner. A structural member that is suitable for both vertical pole members 205 and horizontal support members 106 is disclosed by U.S. Patent No. 6,450,187 B1 to Lin et al., which is incorporated by reference herein.
- 40 **[0016]** Complete details of trampoline 200 and safety enclosure 201 are not shown in Figure 2 for simplicity. For example, safety enclosure includes a mesh- or netting-type of material that extends between adjacent vertical pole members 205 and between horizontal frame members 206 and circular frame member 204 that together with circular frame 204, vertical pole members 205 and horizontal support members 206 operate as a fence around rebounding
- 45 surface 202 in order to keep a user on trampoline 200 and reduce the risk of injury to the user.
- [0017]** According to the subject matter disclosed herein, vertical pole members 205 of safety enclosure 201 attach to the frame structure of trampoline 200 using a plurality of sleeve-joint couplings, of which one is indicated at A in Figure 2. Figures 3A-3D and Figure 4 show details of a first exemplary embodiment of a sleeve-joint coupling according to the subject matter disclosed herein. In particular, Figures 3A-3C respectively show a side view, a top view and an end view
- 50 of the first exemplary embodiment of a sleeve-joint coupling 300 for a trampoline frame according to the subject matter disclosed herein. Figure 3D shows a perspective view of sleeve-joint coupling 300. Sleeve joint coupling 300 is generally shaped as a "T" and includes three arm members 301-303, each having a generally square cross-sectional shape. Each arm member 301-303 receives a trampoline frame member (not shown in Figures 3A-3C) of similar cross-sectional shape into an opening 304 (Figures 3C and 3D). Sleeve joint coupling 300 includes an opening 305, shown in Figure
- 55 3B, that receives a safety enclosure vertical pole member (not shown in Figures 3A-3C) having a generally square cross-sectional member.
- [0018]** Figure 4 depicts View A, shown in Figure 2, in greater detail. In Figure 4, sleeve-joint coupling 300 couples circular frame member 204A to circular frame member 204B and to vertical frame member 203. Circular frame members

204A and 204B are secured to sleeve-joint coupling 300 using, for example, pins 401 and cotter rings 402 (not shown in Figures 3A-3D). Alternatively, circular frame members 204A and 204B can be secured to sleeve-joint coupling 300 using sheet metal screws, and/or bolts and nuts. As yet another alternative, the inner surface of each arm member of sleeve-joint coupling can be threaded to engage complementary threading on each end of a circular frame member 204 and on one end of a vertical frame member 203. Additionally, a threaded connection between sleeve-joint coupling 300 and a frame member can be secured using a pin and cotter ring arrangement, a sheet metal screw and/or a bolt and nut.

[0019] Vertical pole member 205 of safety enclosure 201 is inserted into opening 305 (Figures 3B and 3D) and extends through sleeve-joint coupling 300 into vertical frame member 203 a distance that is sufficient to distribute any shearing and/or torquing forces that may be imparted to vertical pole member 205 along the inside of vertical frame member 203 so that vertical frame member 203 does not fail. Vertical pole member 205 can be secured in vertical frame member 203 using, for example, a pin 401 and a cotter ring (not shown). Alternatively, vertical pole member 205 is secured in vertical frame member 203 using a sheet metal screw and/or a bolt and nut.

[0020] Figures 5A-5C respectively show a side view, a top view and an end view of a second exemplary embodiment of a sleeve-joint coupling 500 for a trampoline frame according to the subject matter disclosed herein. Sleeve-joint coupling 500 is generally shaped as a "T" and includes three arm members 501-503, each having a generally round cross-sectional shape. Each arm member 501-503 receives a trampoline frame member (not shown in Figures 5A-5C) of similar cross-sectional shape into an opening 504 (Figure 5C). Sleeve-joint coupling 500 includes an opening 505, shown in Figure 5B, that receives a safety enclosure vertical pole member (not shown in Figures 5A-5C) having a generally round cross-sectional member.

[0021] Figures 6A-6C respectively show a side view, a top view and an end view of a third exemplary embodiment of a sleeve-joint coupling 600 for a trampoline frame according to the subject matter disclosed herein. Sleeve-joint coupling 600 is generally shaped as a "T" and includes three arm members 601-603, each having a generally oval cross-sectional shape. Each arm member 601-603 receives a trampoline frame member (not shown in Figures 6A-6C) of similar cross-sectional shape into an opening 604 (Figure 6C). Sleeve-joint coupling 600 includes an opening 605, shown in Figure 6B, that receives a safety enclosure vertical pole member (not shown in Figures 6A-6C) having a generally oval cross-sectional member.

[0022] Figures 7A-7C respectively show a side view, a top view and an end view of a fourth exemplary embodiment of a sleeve-joint coupling 700 for a trampoline frame according to the subject matter disclosed herein. Sleeve-joint coupling 700 is generally shaped as a "T" and includes three arm members 701-703, each having a generally triangular cross-sectional shape. Each arm member 701-703 receives a trampoline frame member (not shown in Figures 7A-7C) of similar cross-sectional shape into an opening 704 (Figure 7C). Sleeve-joint coupling 700 includes an opening 705, shown in Figure 7B, that receives a safety enclosure vertical pole member (not shown in Figures 7A-7C) having a generally triangular cross-sectional member.

[0023] Figures 8A and 8B respectively show a side view and a top view of a fifth exemplary embodiment of a sleeve-joint coupling 800 for a trampoline frame according to the subject matter disclosed herein. Sleeve-joint coupling 800 is generally shaped as an "X" or a "+" and includes four arm members 801-804, each having a generally square cross-sectional shape. Each arm member 801-804 receives a trampoline frame member (not shown in Figures 8A and 8B) of similar cross-sectional shape into an opening 805, of which only one opening 805 is shown (Figure 8B). Each opening 805 receives a safety enclosure vertical frame member 203, a circular frame member 204 or a vertical pole member 205 (none of which are shown in Figures 8A and 8B) having a generally square cross-sectional member. It should be understood that sleeve-joint coupling 800 can have an alternative cross-sectional shape, such as any of the exemplary cross-sectional shapes described herein, and a mating vertical frame member, circular frame member and vertical pole member would have a corresponding cross-sectional shape.

[0024] Figures 9A-9C respectively show a side view, a top view and an end view of a sixth exemplary embodiment of a sleeve-joint coupling 900 for a trampoline frame according to the subject matter disclosed herein. Sleeve-joint coupling 900 is generally shaped as a "T" and includes three arm members 901-903, each having a generally round cross-sectional shape. Sleeve-joint coupling 900 also includes a side sleeve member 904 having an aperture 905, configured as a blind hole, that receives a safety enclosure vertical pole member (not shown in Figures 9A-9C) having a generally round cross-sectional member. Side sleeve member 904 has sufficient length and strength to allow a safety enclosure vertical pole to extend into side sleeve member 904 so that the vertical pole would not come out during use. Each arm member 901-903 receives a trampoline frame member (also not shown in Figures 9A-9C) of similar cross-sectional shape into an opening 906 (Figure 9C). In an alternative embodiment, aperture 905 could be configured to allow a safety enclosure vertical pole to extend through the length of the side sleeve member 904 to the ground or to another device that fastens the vertical pole to the corresponding frame member 203.

[0025] Figures 10A-10C respectively show side, top and end views of an exemplary embodiment of a coupling member 1000 for a trampoline frame according to the subject matter disclosed herein. Coupling member 1000 is generally shaped as a "T" and includes three arm members 1001-1003, each having a cross-sectional shape having a portion that is generally round. Each arm member 1001 and 1002 receives a corresponding circular frame member 204. Arm member

1003 receives a corresponding vertical frame member 203. Alternatively, each arm member 1001-1003 has a cross-sectional shape that matches the cross-sectional shape of the corresponding circular frame member and vertical frame member. Arm 1003 of coupling member 1000 is also configured with flange members 1003a and 1003b that receive a vertical pole member 205 of a safety enclosure. Vertical pole member 205 is held in place between flange members 1003a and 1003b with fasteners 1004a and 1004b, such as a bolt 1004a and nut 1004b, that extend through holes (not shown) in vertical pole member 205. Flange members 1003a and 1003b have sufficient length and strength, and fasteners 1004a and 1004b have sufficient strength so that vertical pole member 205 remains in place during use. In an alternative embodiment, vertical pole member 205 could extend past flange member 1003a and 1003b to the ground or to another device that fastens vertical pole member 205 to the corresponding vertical frame member 1003.

[0026] Figure 11 depicts a top cutaway view of the first exemplary embodiment of a sleeve-joint coupling 300 according to the subject matter disclosed herein. Two circular frame members 204A and 204B are shown in Figure 11 respectively engaging arm members 301 and 302 of sleeve-joint coupling 300. A vertical pole member 205 of a safety enclosure is also shown. A frame tension member 1101, such as a strap of webbing, a wire or a cable, is shown threaded through circular frame members 204A and 204B and sleeve-joint coupling 300, in addition the other circular frame members and sleeve-joint coupling forming a trampoline frame. Frame tension member 1101 is fastened in a well-known manner to a hook assembly 1102 that engages a loop 1103 of a buckle assembly 1104 that is accessible through a hole (not shown) in circular frame member 204B. Buckle assembly 1104 has two positions; an open position that allows hook assembly 1102 and loop 1103 to be conveniently engaged, and a closed assembly that places frame tension member 1101 under tension. When frame tension member 1101 is under tension, each sleeve-joint coupling 300 that frame tension member 1101 passes through is urged toward the center of the trampoline frame structure, thereby making the joints of frame structure even more reliable. Alternatively, a plurality of frame tension members can be used to form a line of continuous tension around a trampoline frame instead of a single frame tension member, as depicted in Figure 11. As yet another alternative, frame tension member 1101 could be attached to the outside of sleeve-joint coupling 300, such as through a loop fastened to the outside of sleeve-joint coupling 300. Still another alternative provides that a turn-buckle arrangement is used for placing tension on frame tension member 1101.

[0027] While exemplary trampoline 200 shown in Figure 2 is depicted as being round, it should be understood that the subject matter disclosed herein could be used with a trampoline and safety enclosure having a different shape, such as square, rectangular or oval. Additionally, the sleeve-joint coupling of the subject matter disclosed herein can be made from any suitable material that has sufficient strength to bear the loads and stresses that are associated with trampolines, such as metals and plastics. Further, while the sleeve-joint coupling of the subject matter disclosed herein has been described in terms of vertical frame members and circular frame members fitting into the sleeve-joint coupling, it should be understood that the sleeve-joint coupling of the subject matter disclosed herein can be configured so that one or all of the arm members of the sleeve-joint coupling fit into vertical frame members and circular frame members of the trampoline frame. Further still, while the sleeve-joint coupling of the subject matter disclosed herein has been described as having several exemplary cross-sectional shapes, it should be understood that a sleeve-joint coupling according to the subject matter disclosed herein could have any cross-sectional shape or have arm members having different cross-sectional shapes. As yet another alternative, the sleeve-joint coupling of the subject matter disclosed herein could be formed to be part of a vertical frame member. As still another alternative, the sleeve-joint coupling of the subject matter disclosed herein could be configured to substantially form a "T".

[0028] While the vertical pole members 205 of safety enclosure 201 has been described as extending into vertical frame members 203, it should be understood that at least one or more vertical pole member 205 of safety enclosure 201 could extend to the ground along the outside of a vertical frame member 203, in which case such a vertical pole member would be attached to the corresponding vertical frame member at a minimum of two places, such as by using a sleeve-joint coupling similar to that shown in Figures 9A-9C and, for example, a tie-wrap device near the bottom of a vertical frame member 203.

[0029] As yet another alternative embodiment, a safety enclosure vertical pole member 205 could be configured to form an arch, or an arc shape, between two frame members 203. The two frame members 203 could be adjacent or could be separated by one or more other frame members 203. A horizontal support member would then be connected between adjacent peaks of an arch in a substantially inflexible manner.

[0030] Figure 12 shows a cut-away view of an exemplary embodiment 1200 of a vertical pole member 205 for a safety enclosure 201, a sleeve-joint coupling 200, and a vertical frame member 203 according to the subject matter disclosed herein. Embodiment 1200 includes a tension member 1201, such as a chain, that is attached in a well-known manner to a cap 1202. Tension member 1201 extends from cap 1202 through vertical pole member 205, sleeve-joint coupling 300 and vertical frame member 203 and emerges from an opening 1203 near the base 1204 of vertical frame member 203. The portion of tension member 1201 that emerges from opening 1203 is attached to a ground-fastening device 1205, such as a stake. In use, tension member 1201 is pulled tight and ground-fastening device 1205 is staked to the ground 1206 so that vertical pole member 205, sleeve-joint coupling 300 and vertical frame member 203 remain assembled as a unitary structure as trampoline 200 (Figure 2) is being used. That is, tension member 1201 applies a force

between a vertical pole member 205 and a vertical frame member that compresses the vertical pole member toward the vertical frame member. Ground-fastening device 1205 provides the additional benefit of fastening trampoline 200 to the ground so that trampoline 200 does not have a tendency to move while in use or during high-wind conditions. Tension member 1201 is of sufficient length to allow vertical pole member 205, sleeve-joint coupling 300 and vertical frame member 203 to be disassembled, conveniently packed into a shipping box and remain coupled together.

[0031] It should be understood that while only one vertical pole member 205, one sleeve-joint coupling 300, and one vertical frame member 203 are shown in Figure 12, a tension member 1201, an opening 1203 and stake 1205 should be used at each location that a vertical pole member 205 of a safety enclosure 201 is attached to a sleeve-joint coupling 300 and a vertical frame member 203 for maximum benefit. Additionally, while tension member 1201 is depicted in Figure 12 as a chain, it should be understood that a rope, cord, cable and/or strap could be used that has sufficient strength, weatherability and durability to meet the stresses and weather conditions that would be expected for a recreational structure. Further still, while tension member 1201 has been depicted as internal to vertical pole member 205, sleeve-joint coupling 300 and vertical frame member 203, it should be understood that tension member 1201 could be arranged to be completely external and fastened along side each of or any one of vertical pole member 205, sleeve-joint coupling 300 and vertical frame member 203. It should also be understood that while ground-fastening device 1205 is depicted as a stake, other ground-fastening devices could be used such as a screw-shaped stake or a buried anchor.

[0032] The subject matter disclosed herein also provides a technique for reducing the torque applied to a frame member of a trampoline, thereby minimizing the bowing and the fatigue caused in a vertical frame member of a trampoline.

[0033] Figure 13 illustratively depicts the forces that are applied to an illustrative frame of a trampoline that has spring members that are configured according to the subject matter disclosed herein. More specifically, Figure 13 illustratively depicts a cross-sectional view of a frame 1301 is part of, for example, a circular frame that forms the perimeter of a trampoline. Frame 1301 is disposed on a vertical frame member 1302, such as a leg of the trampoline. A spring member 1303 that is visible in Figure 13 mechanically connects a rebounding surface 1310 (not shown in Figure 13) to frame 1301. In particular, a frame hook member 1304a that is part of spring member 1303 is inserted through a hole 1305a (not plainly shown in Figure 13) that is in the "top" of frame 1301. A second spring member that is disposed behind spring member 1303 and that is not completely visible in Figure 13 is mechanically connected to frame 1301 by having a frame hook member 1304b that is inserted through a hole (not visible in Figure 13) that is in the "bottom" of frame 1301. Each spring member 1303 includes a bed hook member that hooks into, or engages, a connecting ring that is couple to or is part of the rebounding surface. In one illustrative embodiment of the subject matter disclosed herein, all of the spring members that mechanically connect the rebounding surface to frame 1301 are alternately connected to the "top" and "bottom" of frame 1301. In another illustrative embodiment of the subject matter disclosed herein, the spring members that mechanically connect the rebounding surface to frame 1301 are connected to the "top" and "bottom" or frame 1301 is a regular pattern. Figure 14 is an illustrative top view of a portion of a trampoline having spring members 1303 that mechanically connect a rebounding surface 1310 to a trampoline frame 1301 and are configured according to the subject matter disclosed herein. For example, spring members 1303 include a bed hook member 1402 that engages a ring member 1311 of rebounding surface 1310 and a frame hook member 1304 that engages a frame hole 1305.

[0034] As the rebounding surface of the trampoline is jumped on, a horizontal force 1306 and a vertical force 1307 are applied to spring member 1303 that is transmitted to frame 1301, as shown in Figure 13. The alternating nature of each mechanical connection of spring members 1303 to frame 1301, that is, the mechanical connection of the corresponding hook member 1304 through the top and bottom holes 1305, cause a torque 1308a and a torque 1308b to be applied to frame 1301. In particular, spring members that are mechanically connected to the "top" of frame 1301 cause a torque 1308a to be applied to frame 1301. Spring members that are mechanically connected to the bottom of frame cause a torque 1308b to be applied to frame 1301. Torques 1308a and 1308b operate to cancel each other, and thereby reduces the tendency for vertical frame member 1302 to bow outward from the center of the trampoline.

[0035] Figure 15 depicts an illustrative embodiment of a spring member 1500 according to the subject matter disclosed herein. Spring member 1500 includes a frame-hook member 1501 (corresponding to frame hook member 1304 in Figure 13) for inserting through a hole 1305 in a trampoline frame and a bed-hook member 1402 for inserting through a ring attached to a rebounding surface (rebounding surface 1310 in Figure 14). Frame-hook member 1401 includes an end portion 1501 a that is configured to allow insertion of end portion 1501 into a frame hole. Bed-hook member 1502 includes an end portion 1502a that is configured so that end portion 1502a is not exposed and/or easily accessible when spring member 1500 is connected to the "bottom" side of a trampoline frame and thereby potentially causing an injury to a user if the user contacts bed hook member 1502 and end portion 1502a. When properly configured, a gap or space 1503 is provided between end portion 1502a and extension portion 1502b so bed-hook member 1502 can be hook, or engaged, through a connecting ring (not shown in Figure 15) that is coupled to or is part of a rebounding surface. In one illustrative embodiment, bed-hook member 1502 and end portion 1502a are configured so that end portion 1502 is oriented toward extension portion 1502b in a manner that provides a small gap 1503 similar to that shown in Figure 15. In another illustrative embodiment, bed-hook member 1402 and end portion 1502, as illustratively depicted by dashed lines 1504, are configured so that end portion 1402a is oriented substantially parallel to a projection 1505 of the body of spring 1500

and so end portion 1502a is substantially within a projection 1505 of the body of spring 1500. It should be understood that bed-hook member 1502 and end portion 1502a can be configured to substantially more closely conform to projection 1505 of the body of spring 1500 that illustratively depicted in Figure 15. In still another illustrative embodiment, each spring member 1500 that hooks into the "top" or the "bottom" holes of a trampoline frame is configured like illustrative embodiment 1500 shown in Figure 15 and described herein. In yet another illustrative embodiment, only the spring members 1500 that hook into the holes on the "bottom" of a trampoline frame is configured like illustrative embodiment 1500 shown in Figure 5 and described herein.

[0036] While Figure 13 shows only a cross-sectional view of a portion of frame 1301 and while Figure 14 depicts a unitary frame 1301, it should be understood that frame 1301 could be formed from a plurality of frame members that when assembled for a single frame structure.

[0037] Although the foregoing subject matter has been described in some detail for purposes of clarity of understanding, it will be apparent that certain changes and modifications may be practiced that are within the scope of the appended claims. Accordingly, the embodiments of the subject matter disclosed herein are to be considered as illustrative and not restrictive, and the subject matter disclosed herein is not to be limited to the details given herein, but may be modified within the scope and equivalents of the appended claims.

Claims

1. A spring arrangement for a trampoline comprising a rebounding surface, a frame structure having a top portion and a bottom portion, the spring arrangement comprising a plurality of spring members mechanically coupled between the rebounding surface and the frame structure, a first group of spring members being mechanically coupled to the top portion of the frame structure and a second group of spring members being mechanically coupled to the bottom portion of the frame structure.
2. The spring arrangement according to claim 1, wherein the spring members of the first group and the second group are alternately arranged along the frame structure.
3. The spring arrangement according to claim 1, wherein the frame structure is formed by a plurality of frame members.
4. The spring arrangement according to claim 1, wherein each spring member of the second group of spring members has a bed hook member that includes an end portion that is configured to be within a projection of a body of the spring member and is coupled to the rebounding surface.
5. The spring arrangement according to claim 4, wherein each spring member of the first group of spring members has a frame hook member that is mechanically coupled to the top portion of the frame structure and a bed hook member that includes an end portion that is configured to be within a projection of a body of the spring member and is coupled to the rebounding surface.
6. The spring arrangement according to any preceding claim, wherein the frame structure comprises:
 - a plurality of horizontal frame members, each horizontal frame member having two ends; at least one vertical frame member, each vertical frame member having two ends;
 - at least one vertical pole member, each vertical pole member having two ends; and
 - at least one sleeve-joint coupling having first, second and third arm members and an aperture formed in the sleeve-joint coupling, the first arm member and the aperture being disposed in an opposite relationship with respect to each other, the second arm member and the third arm member being disposed in an opposite relationship with each other, the first arm member receiving one end of a vertical frame member, the aperture receiving one end of a vertical pole member, and the second and third arm members each receiving one end of a horizontal frame member.
7. The spring arrangement according to claim 6, wherein the vertical pole member received by the aperture extending through the sleeve-joint coupling into an inner portion of the vertical frame member received by the first arm of the sleeve-joint coupling.
8. The spring arrangement according to claim 6, wherein the vertical pole member being part of a safety enclosure.
9. The spring arrangement according to claim 8, wherein the safety enclosure includes a plurality of vertical pole

members, each vertical pole member being received into the aperture of a sleeve-joint coupling, and a plurality of horizontal support members, each horizontal support member being coupled to two adjacent vertical pole members.

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10. The spring arrangement according to claim 6, wherein the sleeve-joint coupling includes a fourth arm member, the aperture being disposed at an end of the fourth arm member.
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11. The spring arrangement according to claim 6, wherein a tension member is coupled between adjacent sleeve-joint couplings, the tension member applying a force to the adjacent sleeve-joint couplings and forcing the adjacent sleeve-joint couplings toward each other.
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12. The spring arrangement according to claim 6, including a plurality of tension members, each tension member being coupled between at least two adjacent sleeve-joint couplings and applying a force to the adjacent sleeve-joint couplings to force the adjacent sleeve-joint couplings toward each other.
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13. The spring arrangement according to claim 6, wherein the first, second and third arm members of at least one sleeve-joint coupling are arranged to substantially form a "T" configuration.
14. The spring arrangement according to claim 6, wherein at least one sleeve-joint coupling includes a side-sleeve member and the aperture is part of the side-sleeve member.
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15. The spring arrangement according to claim 14, wherein the aperture that is part of the side-sleeve member is a blind aperture.
16. The spring arrangement according to claim 14, wherein the aperture that is part of the side-sleeve member is a through aperture.
17. The spring arrangement according to claim 6, wherein the vertical pole member substantially forms an arch.
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18. The spring arrangement according to claim 6, wherein a tension member applies a force between a vertical frame member and a corresponding vertical pole member that compresses the vertical frame member toward the corresponding vertical pole member.
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19. The spring arrangement according to claim 18, wherein the tension member is one of a chain, cord, rope, cable and strap.
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20. The spring arrangement according to claim 18, wherein the tension member is internal to the vertical frame member and the corresponding vertical pole member.
21. The spring arrangement according to claim 18, wherein the tension member extends through an opening in the vertical pole member, and wherein the frame structure further comprising a ground-fastening device coupled to a portion of the tension member that extends through the opening in the vertical frame member.
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22. The spring arrangement according to claim 18, wherein a ground-fastening device is coupled to a portion of the tension member that is distal to the vertical pole member.
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23. The spring arrangement according to claim 1, wherein the frame structure comprises:
- a plurality of horizontal frame members, each horizontal frame member having two ends; at least one vertical frame member, each vertical frame member having two ends;
- at least one vertical pole member, each vertical pole member having two ends; and
- at least one coupling member having first, second and third arm members, the first arm member and the second arm member being disposed in an opposite relationship with each other, the third arm member having flange members that receive one end of a vertical frame member and a vertical pole member, and the second and third arm members each receiving one end of a horizontal frame member.
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24. The spring arrangement according to claim 23, wherein the vertical pole member is part of a safety enclosure.
25. The spring arrangement according to claim 23, wherein the first, second and third arm members of the at least one

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coupling member are arranged to substantially form a "T" configuration.

26. The spring arrangement according to claim 23, wherein the vertical pole member substantially forms an arch.

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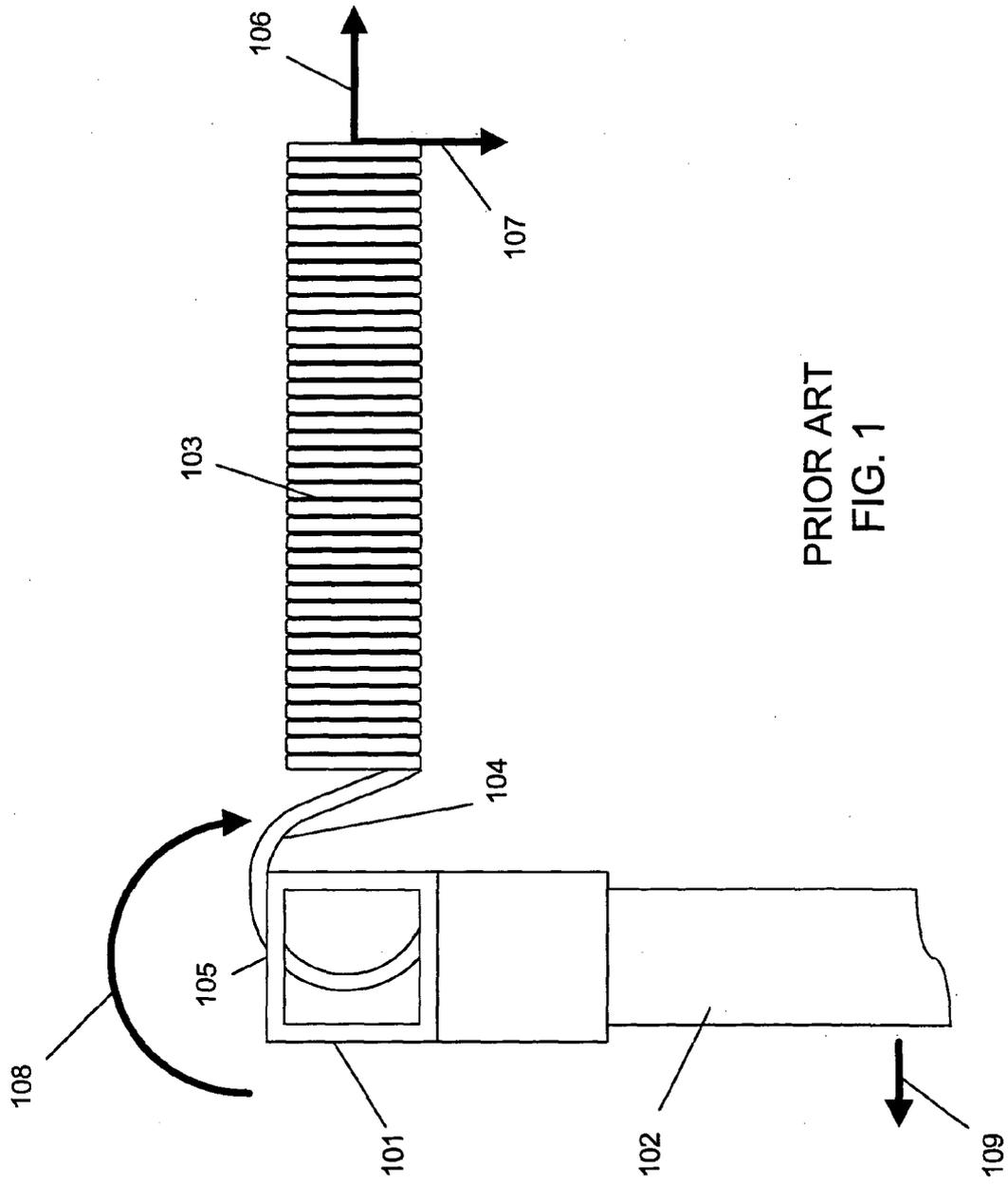
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PRIOR ART
FIG. 1

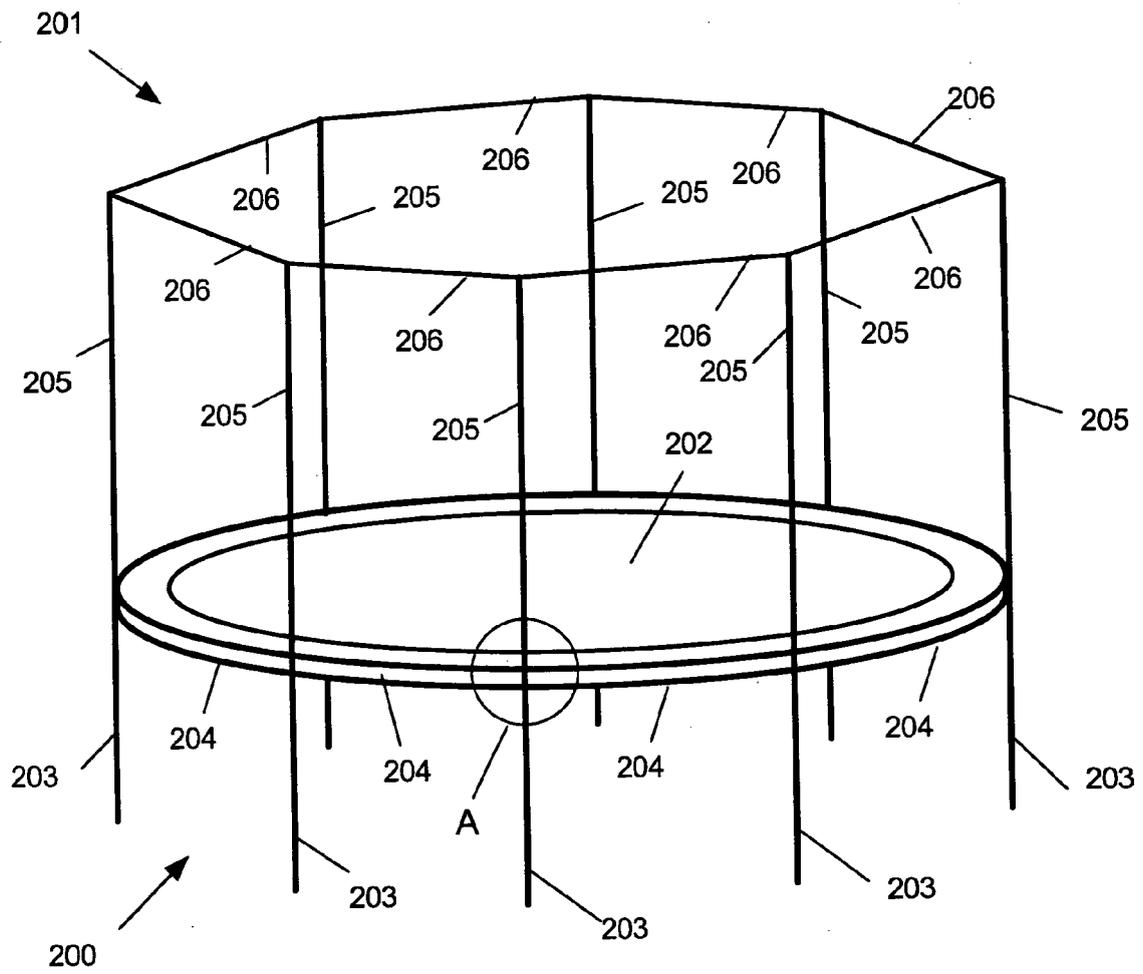


FIG. 2

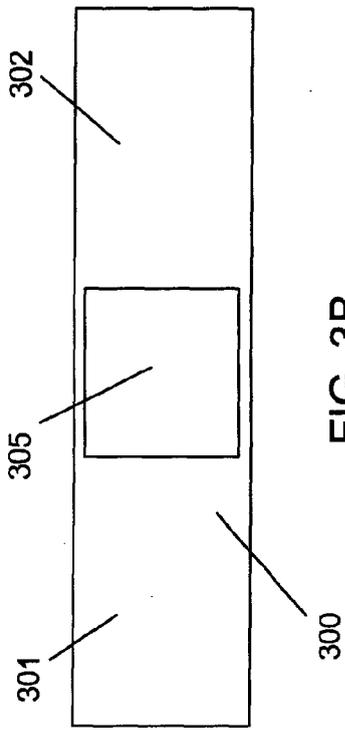


FIG. 3B

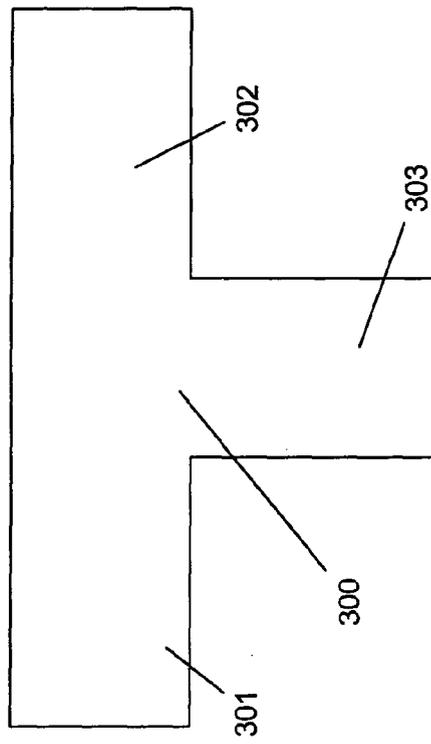


FIG. 3A

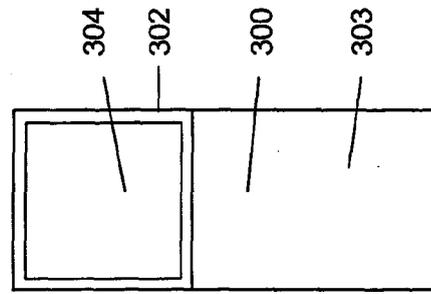


FIG. 3C

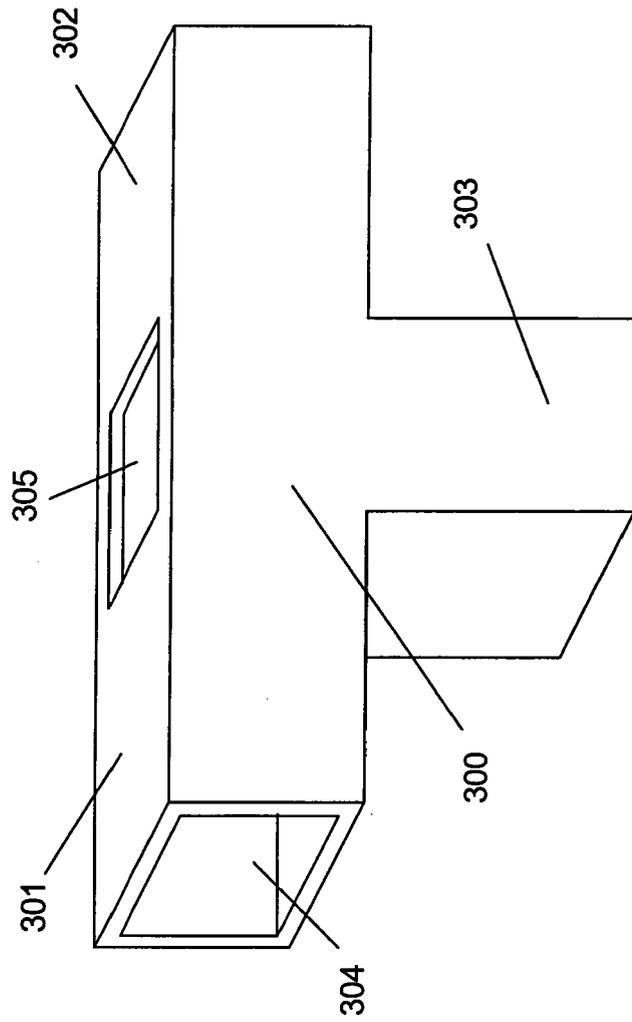
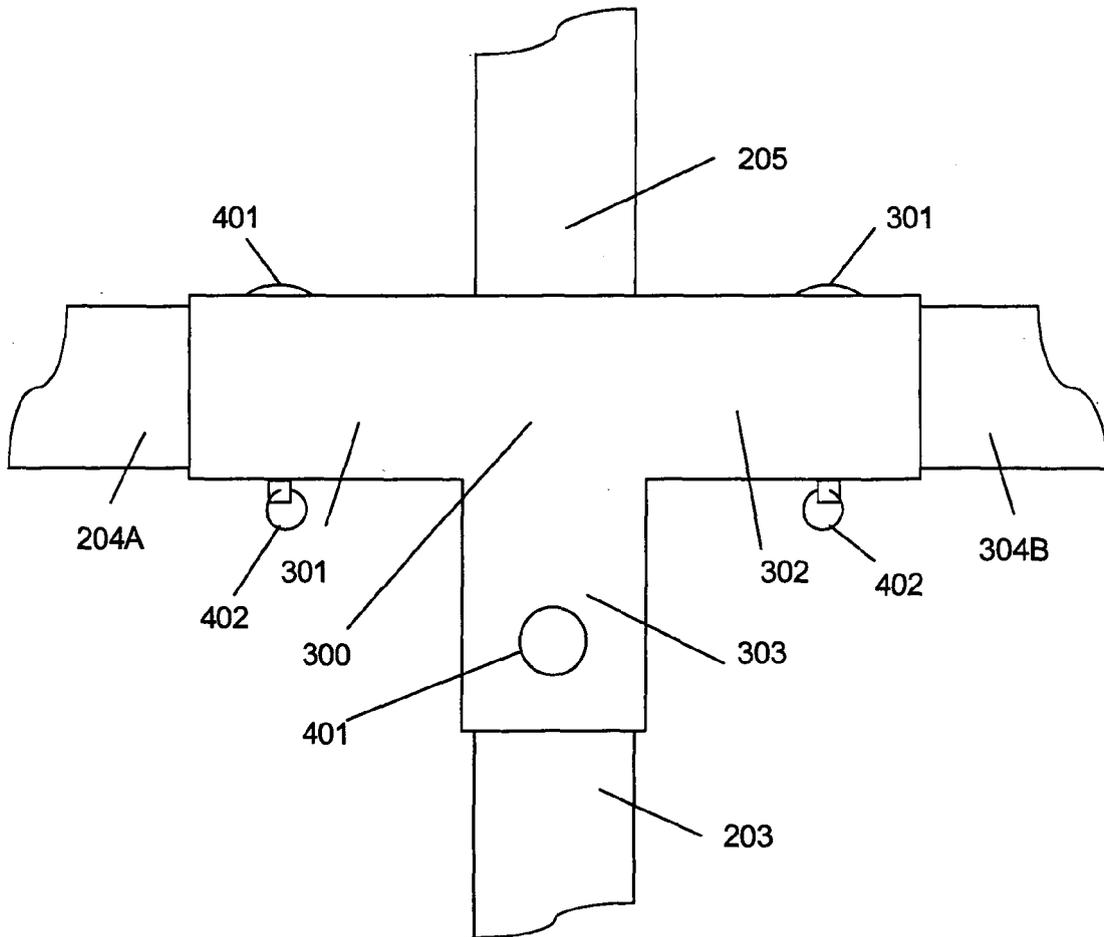


FIG. 3D



VIEW A
FIG. 4

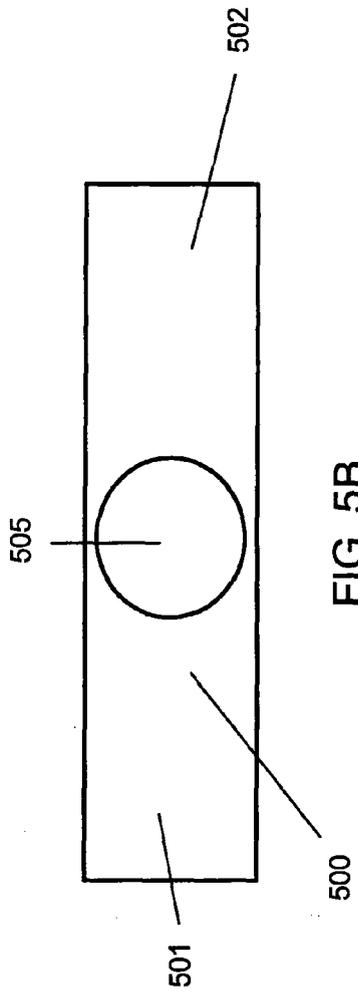


FIG. 5B

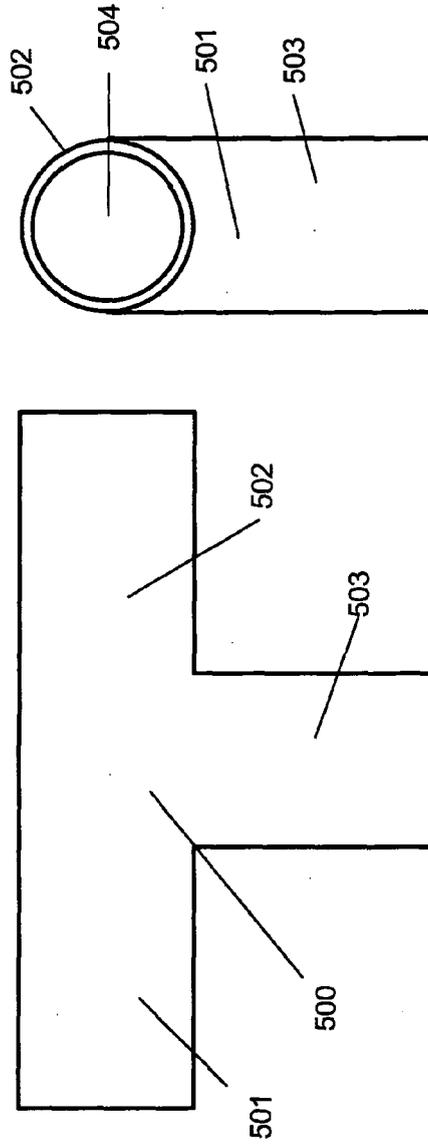


FIG. 5A

FIG. 5C

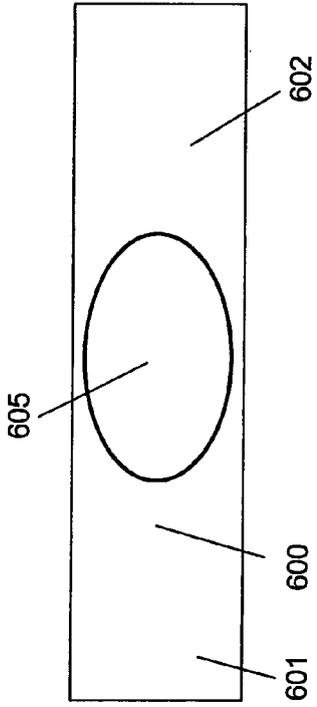


FIG. 6B

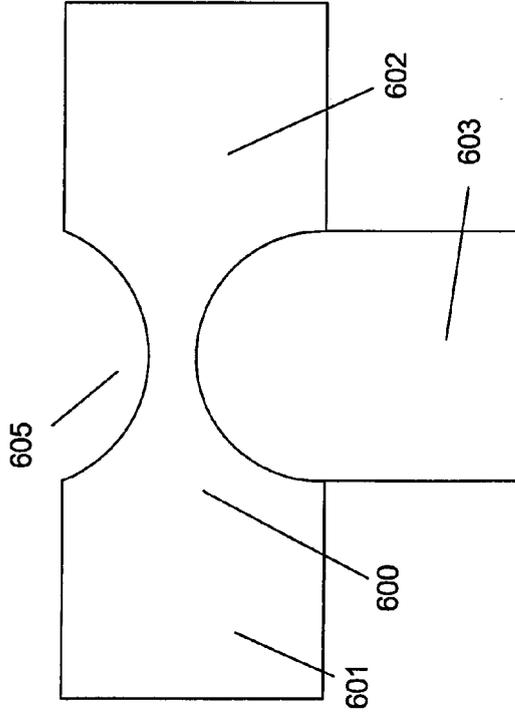


FIG. 6A

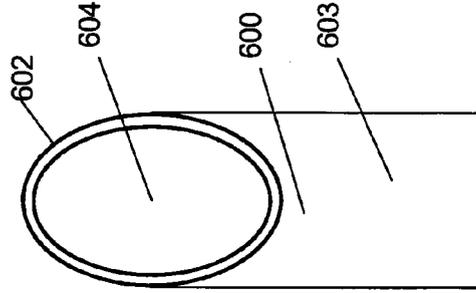


FIG. 6C

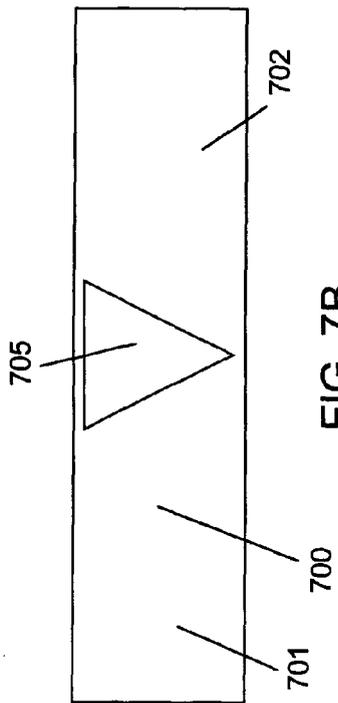


FIG. 7B

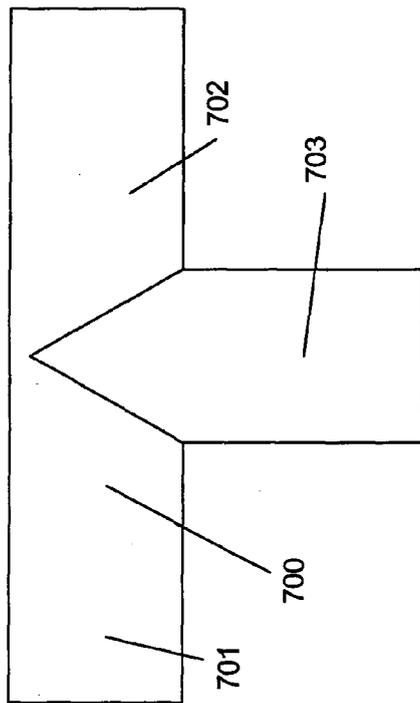


FIG. 7A

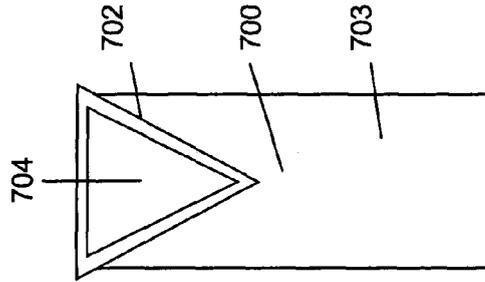
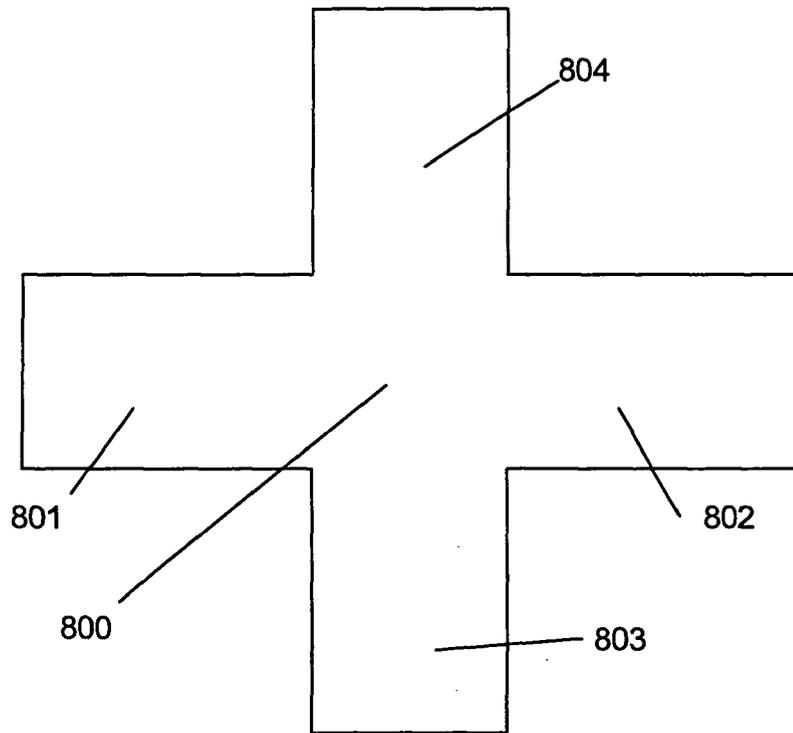
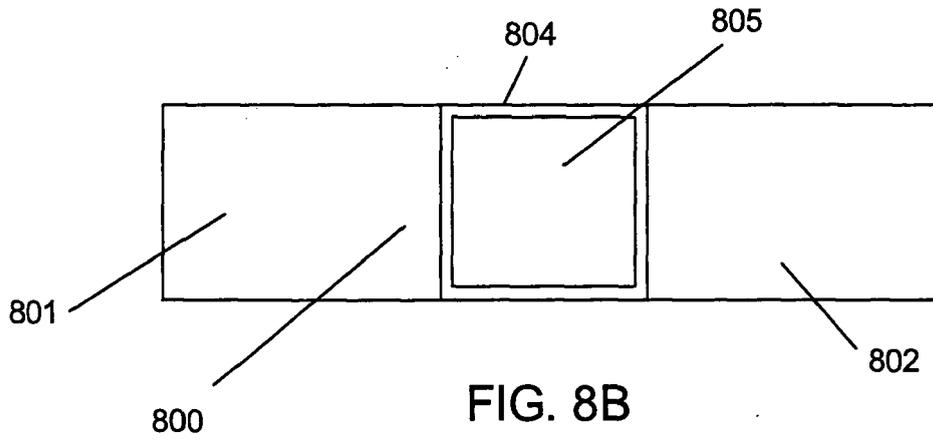
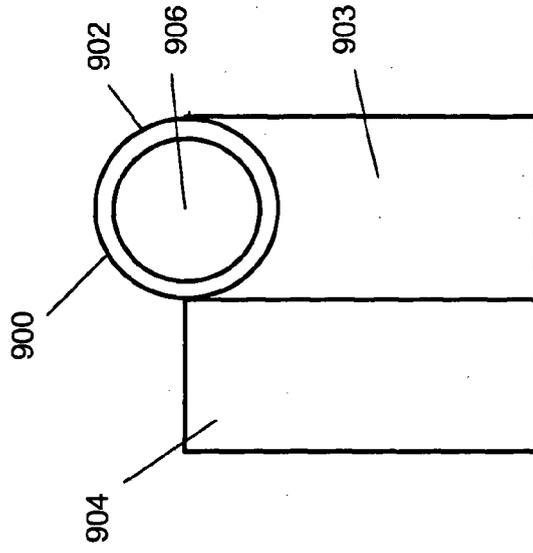
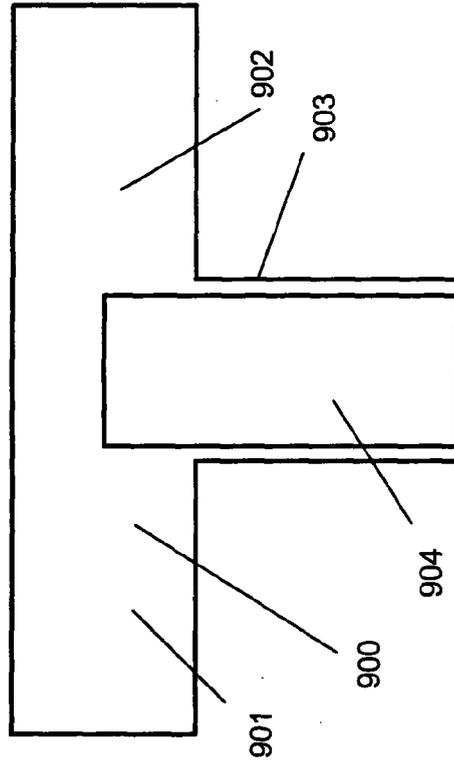
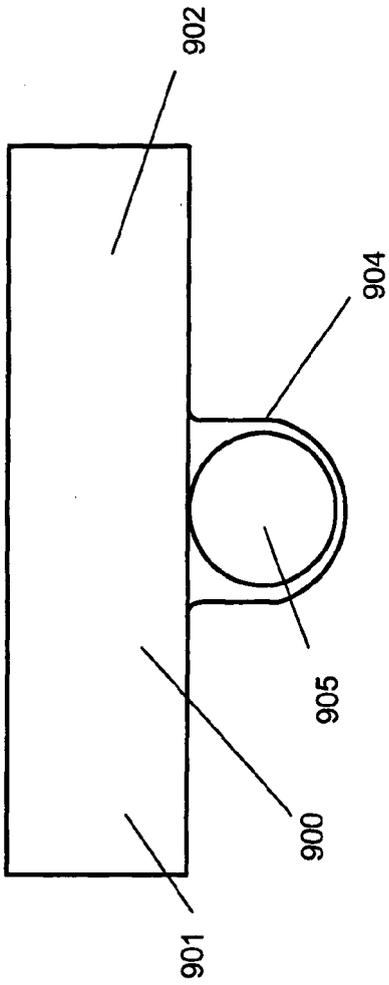
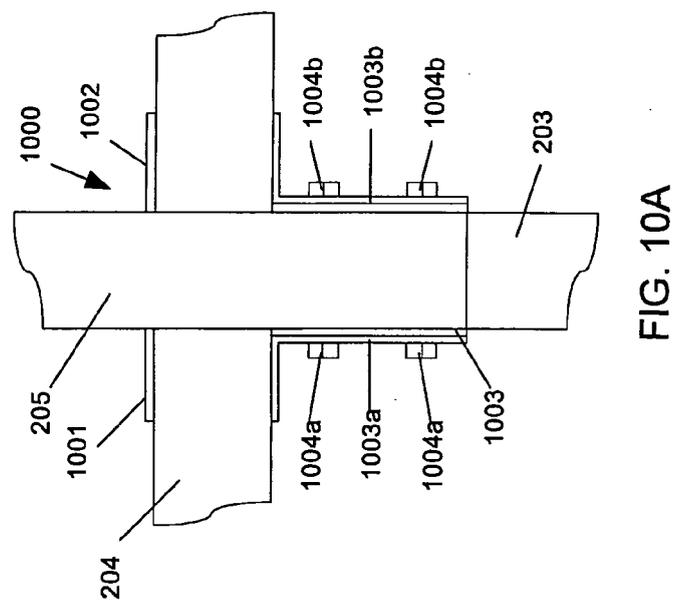
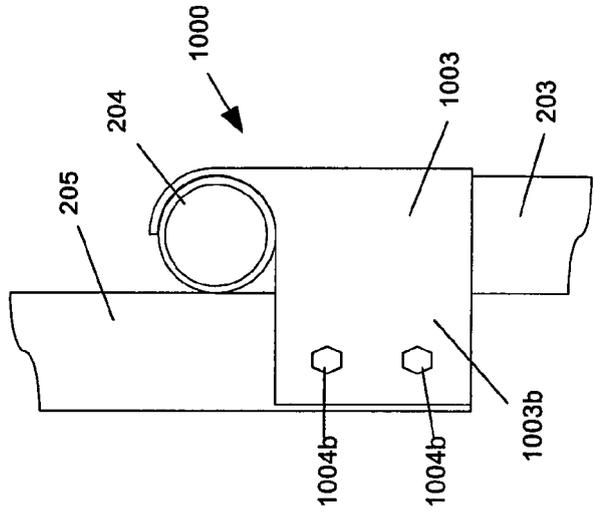
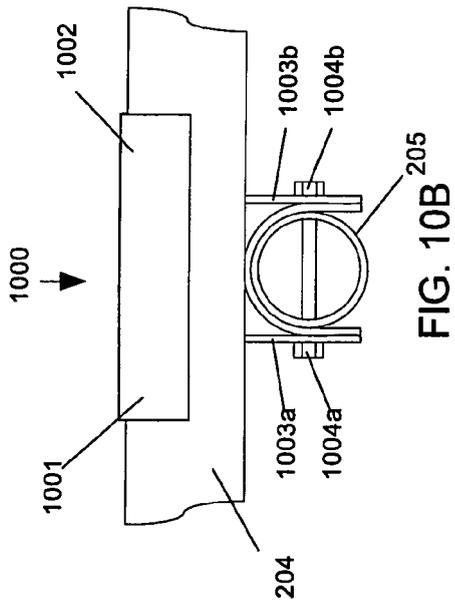


FIG. 7C







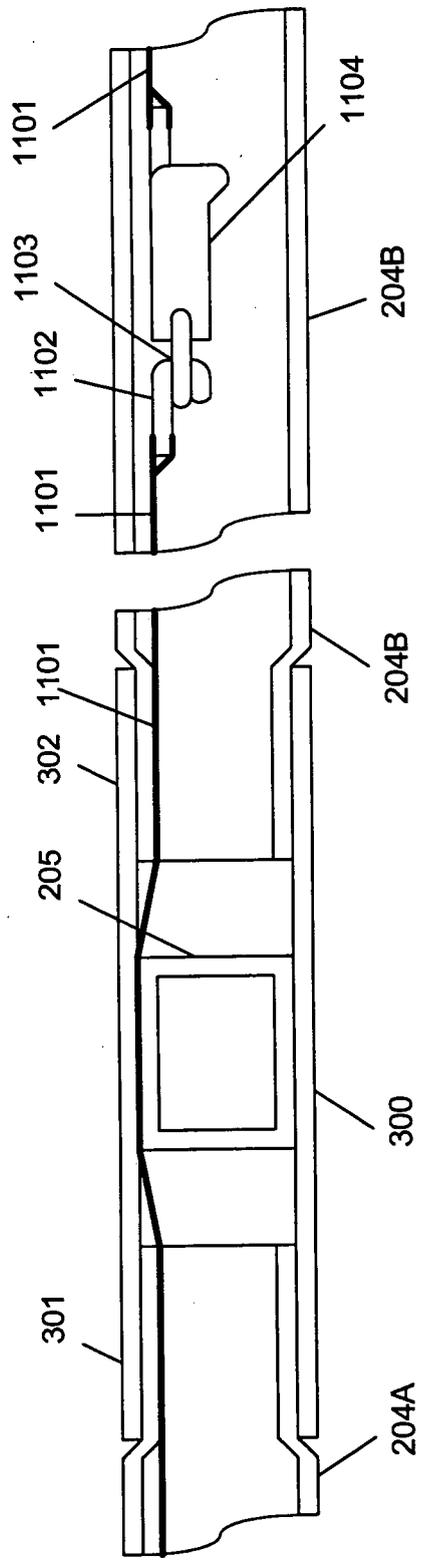


FIG. 11

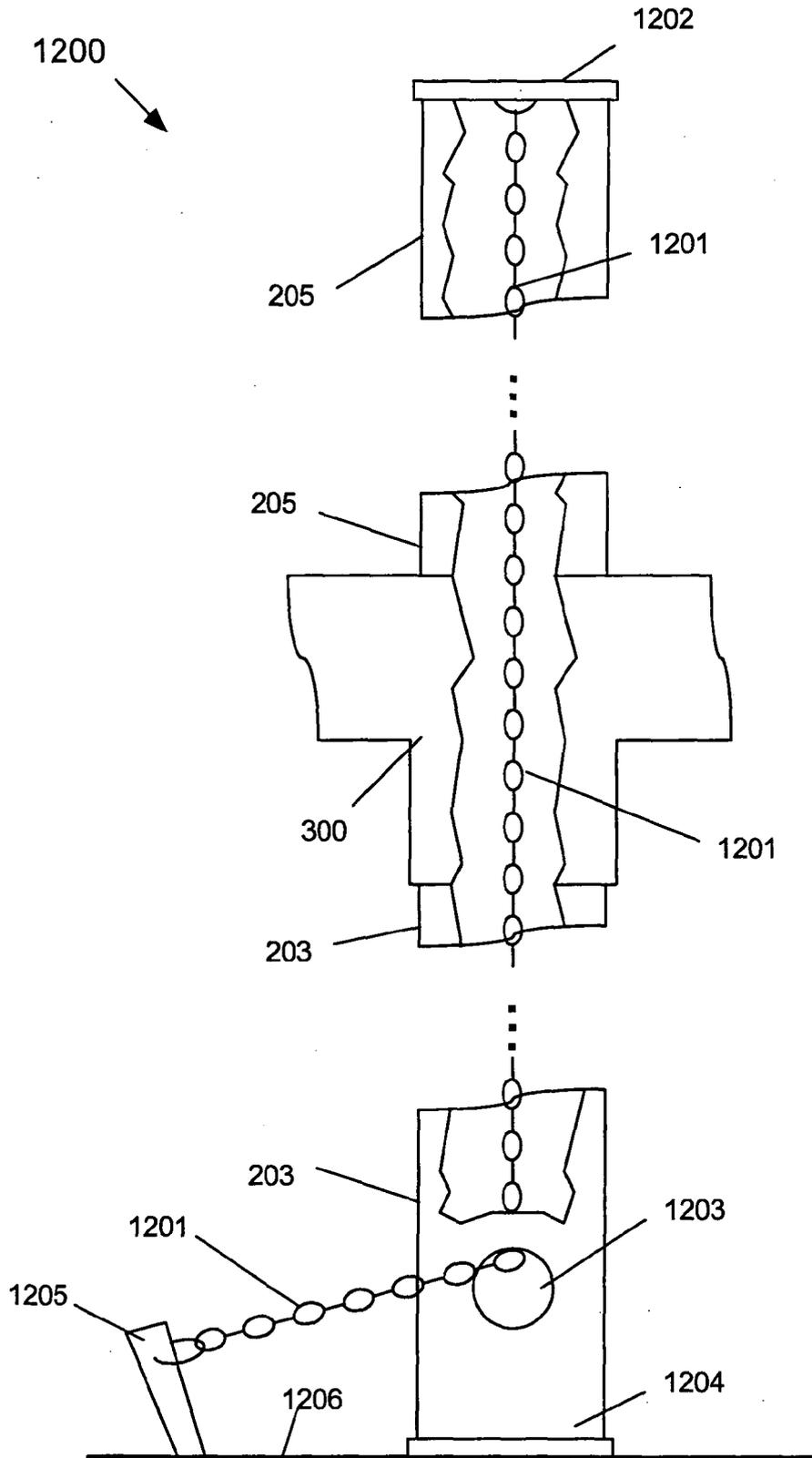


FIG. 12

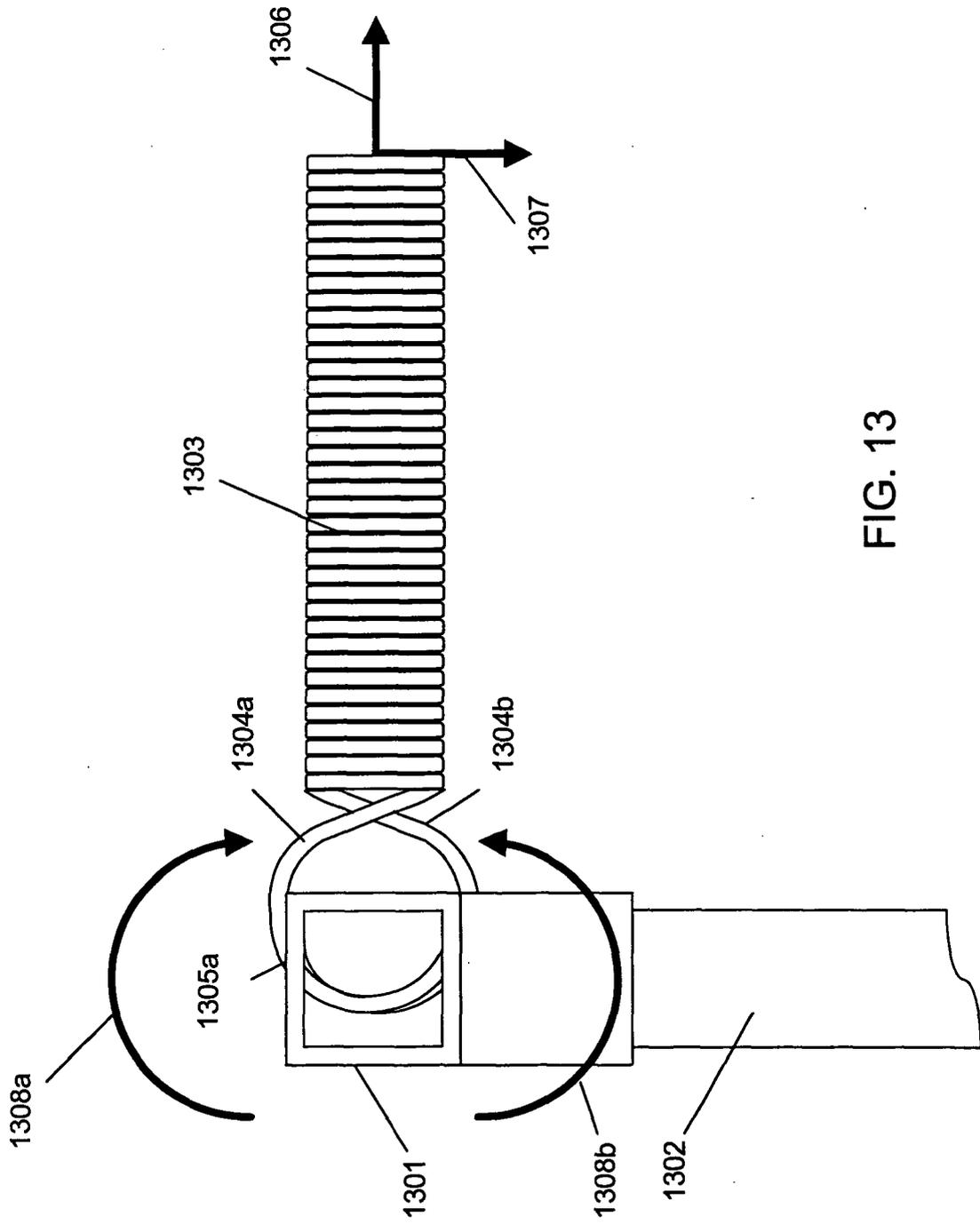


FIG. 13

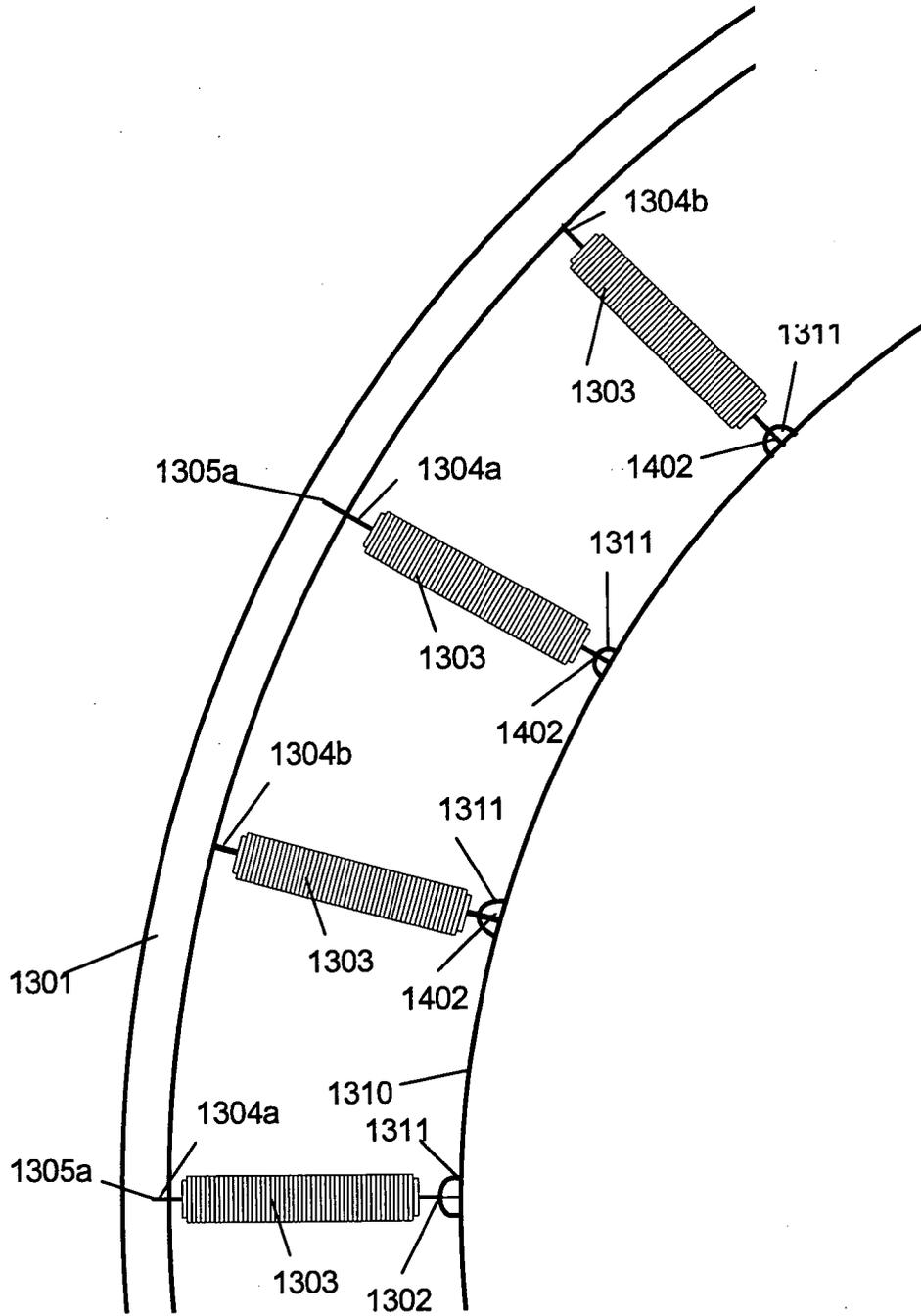


FIG. 14

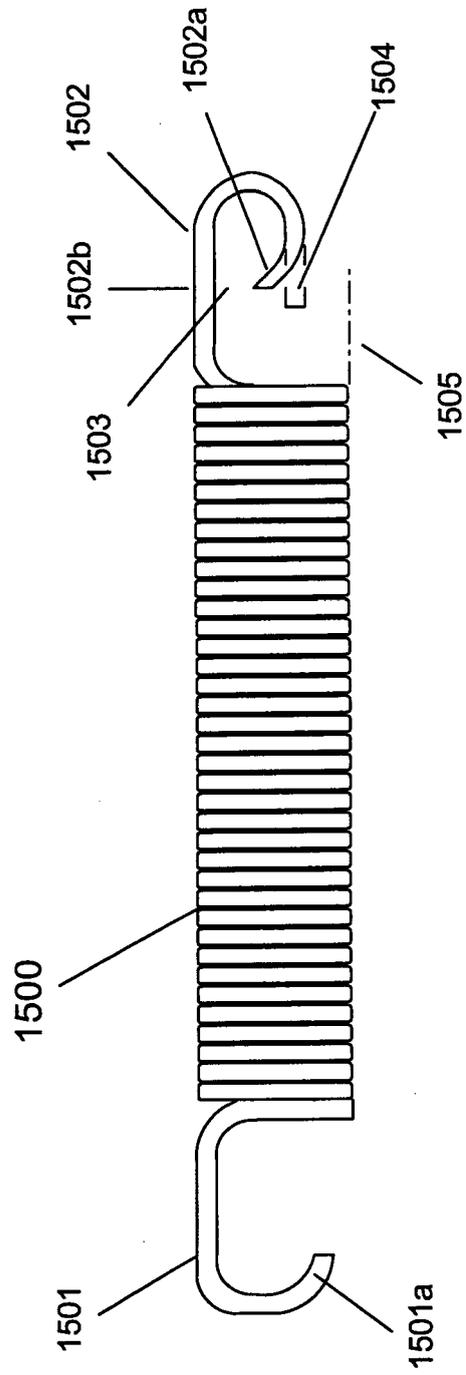


FIG. 15



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 02/13913 A (PUBLICOVER, MARK, W) 21 February 2002 (2002-02-21)	1-9	INV. A63B5/11
Y	* page 4, line 31 - page 5, line 14; figures 1,2,6 *	10-26	
Y	----- US 2004/176214 A1 (YUEH WANG LO CHUN) 9 September 2004 (2004-09-09) * paragraph [0005] * * paragraphs [0017] - [0020]; figures 3,5 *	10-26	
A	----- US 6 237 169 B1 (YING LAI FEN) 29 May 2001 (2001-05-29) * the whole document *	1	
A	----- DE 295 01 890 U1 (HSIANG, HUA-LU, LU-CHU HSIANG, TAO-YUAN, TW) 23 March 1995 (1995-03-23) * the whole document *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			A63B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 30 August 2006	Examiner Lundblad, H
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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EPO FORM 1503 03.82 (F04C01)

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ON EUROPEAN PATENT APPLICATION NO.

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30-08-2006

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